Congressional Notification Profile
DE-PS26-02NT41369

UNIVERSITY COAL RESEARCH PROGRAM, CORE PROGRAM
The Pennsylvania State University

Background and Technical Information:
Project Title: "Intelligent Monitoring System with High-Temperature Distributed Fiberoptic Sensor for Power Plant Combustion Processes."

Pennsylvania State University proposes to develop an "intelligent" fiber-optic sensor that monitors, in real time, high temperatures in power plant boilers.

By monitoring time and space distribution of temperatures within a boiler, researchers can better understand how to reduce pollutants such as nitrogen oxides at the source. A real-time sensor can allow better control of combustion processes and therefore improve plant efficiency.

Contact Information:

Selectee: Pennsylvania State University

Business Contact: John Hanold

Business Office Address: Office of Sponsored Programs
The Pennsylvania State University
University Park, PA 16802

Phone Number: 814-865-1372 Fax Number: 814-865-3377
E-mail: jhh6@psu.edu

Congressional District: PA 5th County: Centre

Financial Information:

Length of Contract (months): 36-60
Government Share: $200,000
Total value of contract: $294,350

DOE Funding Breakdown:
Funds: FY 2002 $200,000

Intelligent Monitoring System with High Temperature Distributed Fiberoptic Sensor for Power Plant Combustion Processes

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ABSTRACT

The proposed project will focus research into the development of an intelligent distributed fiber optical sensor system for real-time monitoring of high temperature in a boiler furnace in power plants. Of particular interest is the estimation of spatial and temporal distributions of high temperatures within a boiler furnace, which will be essential in assessing and controlling the mechanisms that form and remove pollutants at the source, such as NOx. Intelligent distributed parameter estimation coupled with the proposed fiberoptic sensor system is to be used to better estimate the temperature distribution of a boiler furnace and for improved combustion. The basic approach in developing the proposed sensor system is three fold: (1) development of high temperature distributed fiber optical sensor capable of measuring temperatures greater than 2000 C degree with spatial resolution of less than 1 cm; (2) development of distributed parameter system (DPS) models to map the three-dimensional (3D) temperature distribution for the furnace; and (3) development of an intelligent monitoring system for real-time monitoring of the 3D boiler temperature distribution.

An experimental development sequence will be created as a general-purpose long-term capability for reducing theoretical advances in fiberoptic sensors and intelligent system techniques to practice. To efficiently establish the sequence, our research in fiberoptic sensors, boiler furnace modeling, and intelligent monitoring techniques will be incorporated in a modular architecture which will be tested in three types of furnaces in the increasing complexity: a drop-tube reactor, a down-fired combustor, and a 2 million Btu/h research boiler, all at Penn State.

The potential impact of the proposed research is broad and significant. Combustion control of NOx is a critical pressure on utility and industrial boiler operations. Effective schemes for active NOx control are needed and an intelligent in-situ fiberoptic sensor approach promises to be both reliable and cost effective.

Point of Contact:
Prof. Kwang Y. Lee, Principal Investigator
Department of Electrical Engineering
The Pennsylvania State university
University Park, PA 16802
814-865-2621
e-mail: kwanglee@psu.edu

information